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Geomagnetically Induced Currents in Uruguay: Sensitivity to Modelling Parameters.☆

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Abstract

According to the traditional wisdom, geomagnetically induced currents (GIC) should occur rarely at mid-to-low latitudes, but in the last decades a growing number of reports have addressed their effects on high-voltage (HV) power grids at mid-to-low latitudes. The growing trend to interconnect national power grids to meet regional integration objectives, may lead to an increase in the size of the present energy transmission networks to form a sort of super-grid at continental scale. Such a broad and heterogeneous super-grid can be exposed to the effects of large GIC if appropriate mitigation actions are not taken into consideration. In the present study, we present GIC estimates for the Uruguayan HV power grid during severe magnetic storm conditions. The GIC intensities are strongly dependent on the rate of variation of the geomagnetic field, conductivity of the ground, power grid resistances and configuration. Calculated GIC are analysed as functions of these parameters. The results show a reasonable agreement with measured data in Brazil and Argentina, thus confirming the reliability of the model. The expansion of the grid leads to a strong increase in GIC intensities in almost all sub-stations. The power grid response to changes in ground conductivity and resistances shows similar results in a minor extent. This leads us to consider GIC as a non-negligible phenomenon in South America. Consequently, GIC

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